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PATENT REQUEST : STANDARD PATENT

I, being the person identified below as the Applicant, request the grant of a patent to the person identified below as the Nominated Person, for an invention described in the accompanying standard complete specification.

Full application details follow :

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[54] Invention Title

Hollow Flange Structural Element

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HOLLOW FLANGE STRUCTURAL ELEMENT

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(57)

Structural member comprising an intermediate web portion (11) with hollow flange portions (12,13) extending longitudinally along web portion edges and connected to web portion by longitudinally extending portion ((19c, 19d) with TOX POINT connections at intervals along the members length. The web portion may or may not have a flange portion extending longitudinally (16,17) which engages the inner surface of the hollow flange portion (18), and it may be connected thereto. The aforementioned portions are formed from cold-rolled zinc or zinc/alume steel by either roll-forming or brake pressing, and the protective coating is neither damaged by the forming process nor the connection process.

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COMPLETE SPECIFICATION
STANDARD PATENT

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Invention Title : HOLLOW FLANGE STRUCTURAL ELEMENT

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The following statement is a full description of this invention, including the best method of performing it known to me :

"HOLLOW FLANGE STRUCTURAL ELEMENT"

This invention relates to structural elements.

This invention has particular but not exclusive application to web and flange beam type structural elements, for example, I-Beams, Universal Beams and Columns, Wide Flange Beams, Tapered Flange Beams and the like (hereinafter referred to as I-Beams) and for all illustrative purposes reference will be made to such application.

Traditionally, I-Beams have been hot-rolled from structural steel. Such hot rolled steel I-Beams have some inherent structural behavioural problems such as localised buckling of the flange and/or the web elements and buckling of the whole section. Furthermore, such beams are costly to galvanize or paint due in part to their length and weight and the consequent difficulty in transporting them to and from the surface treatment plant. These hot-rolled beams are generally required to be painted or galvanized to prevent corrosion. Consequently, beams selected for use in corrosive environments are undesirably expensive.

Attempts have been made to overcome some of the aforementioned problems associated with hot-rolled steel I-Beams. For example, Palmer Tube Mills Pty Ltd produced a cold-formed hollow flange beam (HFB) comprising a web portion and two hollow flange portions of triangular cross section. The HFB is formed from a single sheet of steel wherein the outer side portions are rolled to form the hollow triangular flange portions and the side edges are welded to the web portion to close the flange. Whilst this type of beam does provide some benefits over the hot-rolled steel beam it is costly and difficult to produce and furthermore the hollow flanges suffer from corrosion as any surface protection applied to the internal surface is likely to be damaged by the welding process. Furthermore, protective coatings must be applied to the outer surface of such beams after welding to protect areas damaged by the welding process.

The present invention aims to alleviate at least one of the aforementioned disadvantages and to provide a structural element which will be reliable and efficient in use.

With the foregoing in view, this invention in one aspect resides broadly in a structural element including :

a web portion and a flange portion connected to said web portion, characterised in that the web portion and the flange portion are individually formed.

In another aspect this invention resides broadly in a method of constructing a structural element including :

forming an elongate web portion;

forming an elongate flange portion having connecting means for connecting said flange portion to said web portion,

and

securing said connection means to said web portion.

Preferably, the connecting means includes a longitudinally extending connecting portion adapted to abut a face of the elongate web portion wherein the connecting portion may be abutted against said face and be secured to the web portion. In such form it is preferred that the connecting portion be continuous, although intermittent connecting portions may be utilised if desired. It is also preferred that the flange portion has a pair of opposed spaced apart connecting portions adapted to receive the web portion therebetween. However, one connecting portion only may be utilised although it is believed that the strength of the beam may be significantly reduced. It is also preferred that the flange portion be substantially tubular in form and symmetrical in cross section and that the connecting portions be positioned such that a pair of flange portions can be connected to opposite edge portions of the web to form a symmetrical I-Beam. In such form it is also preferred that the web portion include a flange

portion which engages the inner face of the tubular flange portion to provide additional strength to the flange portion whereby collapsing of the flange portion may be inhibited. However, if desired the web portion may be formed without the said flange portions and be such that it fits between the connecting portions of the flange portion without engaging the inner face of the tubular flange portion.

Preferably the web portion and flange portion are formed from cold-rolled steel whereby a structural element having a higher strength to weight ratio than hot rolled structural elements can be constructed. It is also preferred that such steel is coated with zinc, zinc/alume, or other anti corrosion material prior to forming the elements for the beam, such as is available from steel manufacturers such as BHP Sheet and Coil Products Division.

The web portion may be formed separately to the flange portion and subsequently secured thereto or alternatively the flange portion may be formed about the web portion, for example, in a continuous rolling process.

Preferably, the flange portions are secured to the web portions by a process wherein the strength and/or corrosion resistance properties of the steel or its coating are not significantly effected. Preferably such process is a cold drawing process such as the TOX POINT process by TOX SYSTEMS PTY LTD in which abutting layers of material are pressed in a punch and die where neither material is cut or punched such that one layer forms a recess and the other forms a protuberance which is captured in the recess. However, other processes or methods of connecting the flange portions to the web portion such as the use of screws, rivets, bolts, adhesive or the like may be utilised if desired. Thus the beam does not require any anti-corrosion treatments to be applied during or after manufacture as required with both the hot-rolled beam and the (HFB).

Transverse stiffeners may be secured to the said web portion at intervals along the member's length between the said hollow flange portions. Preferably the said transverse stiffeners will be a right angle section wherein one leg abuts the said web portion such that the second leg protrudes out from the said web portion providing stiffness against buckling. However other sections which provide the additional stiffness may be utilised. Preferably the said transverse stiffeners are secured to the said web portion by TOX POINT connections. However, other methods of connections as discussed above may be utilised.

In order that this invention may be more readily understood and put into practical effect, reference will now be made to the accompanying drawings which illustrate a preferred embodiment of the invention and wherein :

FIG. 1 is a pictorial representation of an I-Beam constructed according to the invention;

FIG.2a is a pictorial representation of the web of the beam of Fig.1;

FIG.2b is a sectional view of the web of Fig.2a along line 2A-2A;

FIG.3a is a pictorial representation of the flange of the beam of Fig.1;

FIG.3b is a sectional view of the flange along line 3A-3A;

FIG.4a is a number of cross sectional views of various alternative webs;

FIG.4b is a number of cross sectional views of various alternative flanges;

FIG.4c is a number of cross sectional views of various alternative penetrations;

The I-Beam 10 illustrated in the drawings includes a longitudinally extending web 11 and two spaced apart flanges 12 and 13 fixed thereto, all formed from 2.5mm Hi-Tensile cold-rolled thin sheet steel coated with zinc. Other thicknesses of material can be utilised but a preferred range of thickness is 0.8 and 6mm. The web 11 is a substantially Z-

Section having z-flanges 16 and 17 extending along its full length as more clearly illustrated in Figs. 2a and 2b.

The flanges 12 and 13 are substantially tubular in form and of substantially rectangular cross-section having long sides 18 and 19 and short sides 20 and 21. The long side 19 comprises two part sides 19a and 19b separated by a narrow longitudinally extending gap 22 defined by two spaced apart outwardly extending returns 19c and 19d.

The z-flanges are encapsulated by the tubular flanges 12 and 13 respectively and the returns 19c and 19d abut the opposite sides of the web 11 inwardly of the z-flanges. The flanges 12 and 13 are secured to the web 11 by deforming the returns 19c and 19d and the abutting web 11 at intervals along the length of the beam by the TOX system as previously mentioned. However, other methods of securing the flanges to the web such as by self-piercing rivets, for example the HENROB self-piercing rivets may be utilised. However, advantageously, the TOX POINT cold drawing process does not require any additional fixing element, utilising the web and flange material only.

As can be seen in Fig. 1 the z-flanges 16 and 17 abut the inner faces of the long sides 18 and 19 respectively such that loads applied to the long sides 18 are transferred in part to the Z-Flanges thereby inhibiting collapsing of the flanges 12 and 13.

The web 11 and flanges 12 and 13 may take any number of forms as illustrated in Figs. 4a and 4b and penetrations of any suitable shape and size may be made in the web to allow for the passage of building services or to change the acoustic properties or the like of the beams. Examples of such penetrations are illustrated in Fig. 4c.

A typical range of sizes for the aforementioned web portion and hollow flange portions is :

35mm - 100mm for sides 20 and 21;

100mm - 300mm for side 18;

15mm - 35mm for sides 19c, 19d, and flanges 16, and 17;

2mm - 8mm for gap 22;

and,

100mm - 700mm for web 11;

However, other dimensions as may be practical are deemed to be included.

It will of course be realised that while the above has been given by way of illustrative example of this invention, all such and other modifications and variations thereto as would be apparent to persons skilled in the art are deemed to fall within the broad scope and ambit of this invention as is herein set forth.

CLAIMS

1. A method for the formation of a structural member having a web portion and hollow flange portions extending longitudinally of the edges of said web portion, said method including the steps of:

cold-roll forming strip of cold-rolled steel into said hollow flange portions which are substantially tubular with connecting means extending longitudinally;

cold-roll forming a second strip of cold-rolled steel into said web portion with flanges at each edge extending longitudinally;

guiding said web portion into said hollow flange portions such that the flanges of the said web portion engage the inner face of the said hollow flange portions, and;

securing the said web portion to the said hollow flange portions by installing TOX POINT connections in the said connecting means at intervals along the member's length.

2. A method as claimed in claim 1 wherein the said web portion flanges are secured to the inner face of the said hollow flange portions by TOX POINT connections at intervals along the member's length.

3. A method as claimed in claim 1 wherein the said web portion does not have flange portions and does not engage the inner face of the said hollow flange portion.

4. A method as claimed in claims 1 to 3 wherein said hollow flange portions are roll-formed about the said web portion in a single mill or adjacent mills thus providing for a continuous formation process.

5. A method as claimed in claims 1 to 4 wherein additional transverse stiffeners are secured to the said web portion between the said hollow flange portions by TOX POINTS at intervals along the members length for stiffening purposes.

6. A method as claimed in claims 1 to 5 wherein the TOX POINT connections are replaced by other connecting processes as deemed appropriate.

7. A method as claimed in claims 1 to 6 wherein the said web portion and said hollow flange portions are brake pressed rather than roll-formed.

8. A structural member whenever made in accordance with the preceding claims.

9. A structural member whenever made in accordance with the preceding claims wherein said web portion and said hollow flange portion are formed from metal strips of different thicknesses.

10. A structural member whenever made in accordance with the preceding claims wherein said web portion and said hollow flange portion are formed from metal strips of different metallurgical properties.

11. The protective coating applied to the raw steel prior to manufacture gives inherent corrosion protection of the member eliminating the need for subsequent protection processes.

12. A structural member whenever made in accordance with the preceding claims substantially described herein with reference to the accompanying drawings.

ABSTRACT

Structural member comprising an intermediate web portion (11) with hollow flange portions (12,13) extending longitudinally along web portion edges and connected to web portion by longitudinally extending portion ((19c, 19d) with TOX POINT connections at intervals along the members length. The web portion may or may not have a flange portion extending longitudinally (16,17) which engages the inner surface of the hollow flange portion (18). and it may be connected thereto. The aforementioned portions are formed from cold-rolled zinc or zinc/alume steel by either roll-forming or brake pressing, and the protective coating is neither damaged by the forming process nor the connection process.

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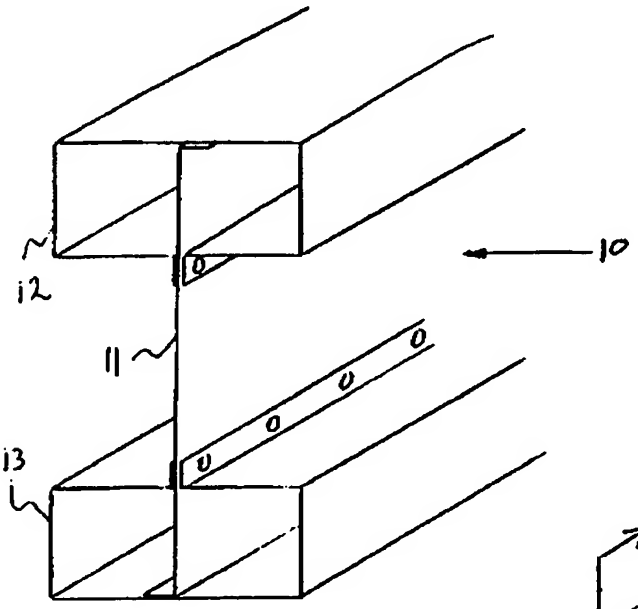

FIG 1

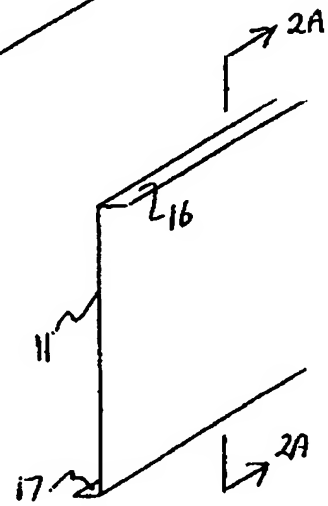

FIG 2a

FIG 2b

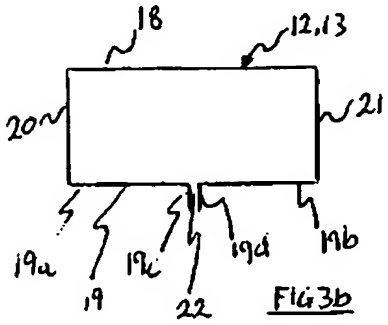

FIG 3b

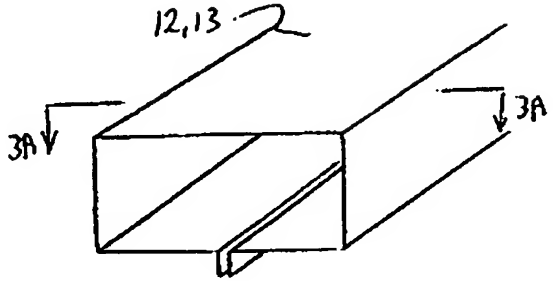

FIG 3a

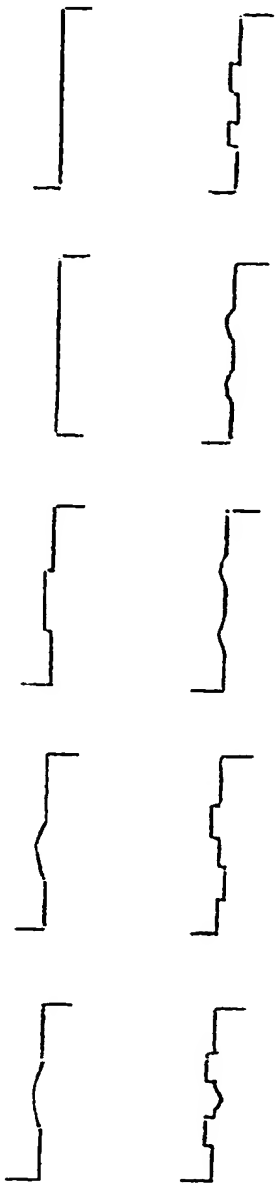

FIG4a

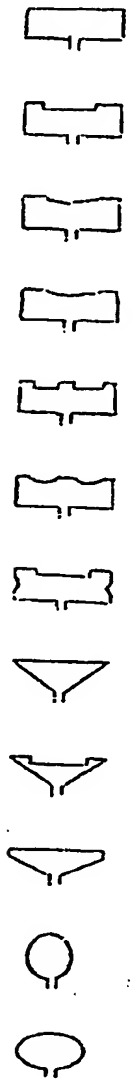

FIG4b

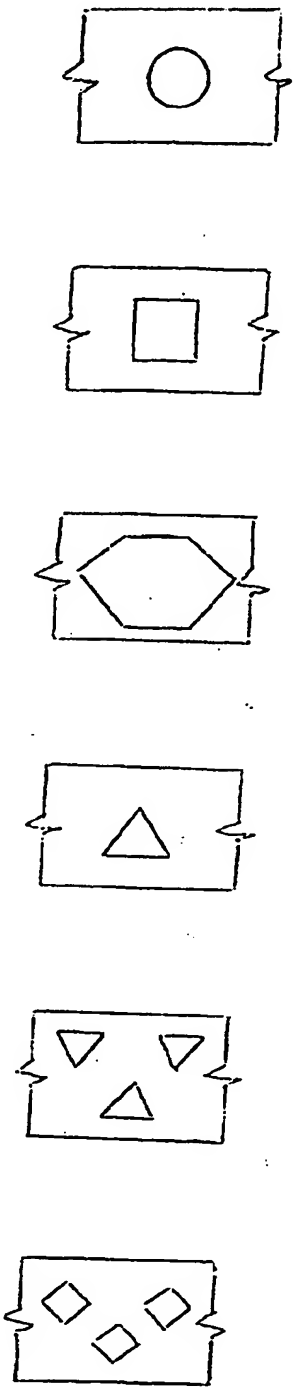

FIG.4C